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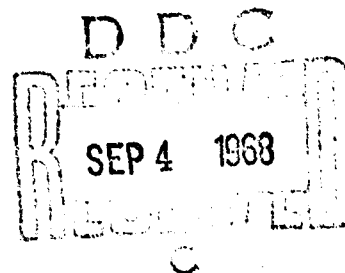
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14

PROBABLE METHOD OF SPREADING EPIDEMICS OF  
DERMATOPHYTOSIS OF THE GROIN (\*)

- Portuguese -

[Following is a translation of an article by  
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Maria Hospital, Lisbon and N. Canova Xavier,  
student of the Lisbon Medical School, in the  
Portuguese-language periodical, O Medico  
(The Doctor), Porto, Portugal, Reprint No  
605, pages 12-19, 1963.]

A. INTRODUCTION

During the winter of 1961 in the Dr. Jose de Almeida  
(Parede) Sanatorium, there were numerous patients who had  
erythematous scaly lesions in the groins. Some of the cases  
were studied in this Clinic, where they were diagnosed as  
dermatophytosis of the groin, after mycological confirmation  
by direct examination and by culture. It was planned, there-  
fore, to investigate the method of spreading epidemics and  
establish prophylactic measures.

B. PRELIMINARY INVESTIGATION

The Sanatorium has two floors and specializes in the  
treatment of osteo-articular tuberculosis. There are five  
men's wards (A,B,C,D,E) with a total of 137 patients, among  
whom 30 cases of dermatophytosis of the groin were diagnosed  
at the beginning of the study. It was found that the major-  
ity of the lesions which developed disappeared spontaneously  
after a few weeks. This fact, already recognized in publica-  
tions (1,2) was referred to by many patients, proved by the  
nursing staff and confirmed during this investigation. Some

lesions disappeared in two to four weeks without receiving any treatment at all; in other cases an irregular topical application of medicines, such as a 1% tincture of iodine or tincture of Arning (1) produced the same result. Only patients had progressive lesions (that lasted longer than a month) localized in the groins and on other parts of the hairless skin. These lesions disappeared completely after ten days of treatment with griseofulvin (Grisovin P.P. "Glaxo" (2), using a dose of 500 mg daily). The rapid healing after mild local treatments in other forms of dermatophytosis and the cure with griseofulvin in much less time than is generally necessary in other locations, indicate a natural tendency for the infection to be cured spontaneously. For this reason, a more detailed study of the cure was not made and more attention was given to the study of ways of spreading the disease.

There is also a small women's section located in a ward completely isolated in one end of the building. There was never noted any suspicious lesion on any of the six patients interned. It has been noted that dermatophytosis of the groin is found less frequently in women (1,3,4), and personal experience confirms this. Thus, in 95 cases observed between 1945 and 1958 (5) and in 98 cases between 1959 and 1961 (6), there were recorded only four and 21 women, respectively. This fact is attributed to differences in body structure and dressing habits. It is thought that the scrotum (1) and the use of trousers favor the growth of fungi in the groins of the men and that the women have less probability of contagion (4). The women patients interned in the sanatorium live completely isolated from the men's wards; use private lavatories; have more meticulous hygiene habits with daily perineal washings and use their own clothes which are washed separately. Only the bed clothing is mixed with that of the men and washed together.

### C. INVESTIGATION OF SOURCES AND METHODS OF CONTAGION

Material and methods: To investigate probable human sources, observations of the lesions in the groins of all the interned patients were made by direct microscopic examination and by culture in the suspected cases. A study was further made, by culture only, of the dermatophytosis between the toes of all the interneers. The medium used was Mycobiotic-agar "Difco" which contains Sabouraud's agar with glucose containing cycloheximide and chloramphenicol.

To determine the method of spreading the disease, the living habits and hygiene of the group were analyzed, and dermatophytes on pieces of clothing or other objects that touched the affected areas were studied, as were also those found inside shoes and on the floor of some of the rooms of the hospital. In the case of clothing, direct pressure was made on the surface of the plates by means of culture; with other objects, a sterilized swab was rubbed on the respective surface and cultivated immediately on plates, while the technique described by Gentiles (8) was used to study dermatophytes found on the floor.

#### Results:

##### 1. Probable Sources

##### a. Study of lesions and respective organisms

Among 137 men, 30 cases were found (21% dermatophytosis of the groin, confirmed microscopically; in 21 the organism was identified: Epidermophyton floccosum in 13 and Trichophyton rubrum in nine (Table 1).

Table 1

Cases and Respective Organisms Diagnosed  
in the First Study

Ward	Total Beds	Patients With Lesions	Dir Ex Positive	Positive Cultures		Negative Cultures
				E Floc	T rubr	
A	28	10	10	5	-	5
B	30	8	8	3	4	1
C	21	5	5	2	2	1
D	28	4	4	2	1	1
E	30	3	3	1	2	-
Total ..	137	30	30	13	9	8

The ages of the patients varied between 14 and 55 years of age. In eight cases (six with T rubrum and two

with E floccosum) there were simultaneous lesions in other spots: thighs and legs (five cases), buttocks (two cases) and trunk, arms and legs and face (one case). At least 10 other in-patients (10%) had had similar lesions in preceding months.

With the exception of Ward A, where E Floccosum was isolated, in all the positive cases, both kinds of dermatophytes were found in equal proportion in the wards. More cases were found in the wards of the second floor (A, B, C: 23 cases) than on the first (D, E: seven cases). The infected patients, scattered about the wards were not limited to any fixed zone. They occupied beds intermixed with other patients free of the disease. There were only seven cases in adjacent beds (two groups of two beds and one of three). In one of the groups the organisms were different; in the rest of them it was impossible to establish an ethiological relationship, because the cultures were negative.

#### b. Study of dermatophytes on the feet

Dermatophytes were isolated between the toes of only four of the 137 patients (2.9%): E floccosum in three and T mentagrophytes in one. All of these cases had lesions in the groins (E floccosum in three, including the patient with T mentagrophytes on the feet, and T rubrum in one, on whose feet were also found E floccosum).

## 2. Living Habits and Hygiene

Most of the patients remained in bed, occupying the same bed until they were discharged. A few walked about the wards and solariums some of the time. Although an effort was made to keep the patients in bed, some got up to use the lavatories. In such cases, they either went barefoot or in slippers belonging to the Sanatorium and which had already been used by numerous individuals.

All the men use briefs [a loincloth-type of garment] and shirt; when asked to get up they put pajamas over these. The bedclothes are changed once a week. All of the clothing mentioned belongs to the Sanatorium and is washed in the laundry of another hospital in Lisbon. Since there was an increase in the incidence of dermatophytosis of the groin, the briefs have been changed daily and sterilized in an autoclave. Such measures did not reduce the spread of the disease.

The patients wash their hands and face daily, using individual towels which are washed weekly. The great majority only wash the perineal and inguinal regions once a week when they take a bath. There are three bathhouses for the three wards. In each there is a bathtub with a wooden platform and an adjacent toilet and urinal. The patients are taken there in a group and washed by orderlies. All the soiled clothing is sent in sacks to the laundry. The orderly puts each patient, completely undressed, on the wooden platform and washes him with a spray of water, rubs him with soap and again rinses with water, drying him afterwards with individual towels which are then mixed with the dirty clothes. After which, each patient is dressed in clean clothes and the bathtubs and platforms are washed with jets of clean water.

Some patients evacuate and urinate in porcelain toilets; others use glass urinals and metal bedpans. These objects are washed with water, soap and lye and sometimes with salt, vinegar and calcium hypochlorite (commonly called "cloreto").

3. Study of Extrahuman Carriers -- Table no 2 summarizes the results of the study of dermatophytes on pieces of clothing and other objects that came in contact with the lesions. Cultures were grown rather frequently from organisms isolated on briefs, pajama pants, shirts and bed sheets. The same organisms were found on urinals, toilets and bedpans.

Table 2

Study of Dermatophytes Extrahuman Sources

Object	Total Exam	Total Posi	Results	
			E floc	T rubr
Briefs ... ..	15	5	5	1 (*)
Pajama Pants ..	4	2	1	1
Shirts ... ..	6	2	1	1
Sheets ... ..	25	8	7	2 (*)
Glass Urinals ...	4	1	1	-
Metal Bedpans ..	10	2	-	2
Porcelain Toilets ...	10	1	1	-

Platforms (bathtub) ...	12	-	-	-
Floor (bathhouses) ...	15	-	-	-
Shoes ... ..	8	-	-	-

(\*) From briefs and sheet of a patient with lesions caused by T rubrum, both E floccosum and T rubrum were isolated.

At the beginning of the study, there was not noticed any appreciable difference in the living habits and hygiene of the infected patients and those who were immune (some of the latter, however, had previously had lesions. Apparently, the habits of the male group were very uniform.

The four persons on whose feet were found dermatophytes remained, as a rule, in bed but sometimes got up to go to the toilet, barefoot or with shoes. However, fungi were not found either in the shoes or on the floor.

The study of fungi on clothes was made exclusively on clothing used by infected patients. Dermatophytes were found on 17 pieces of clothing, corresponding to eleven patients. In nine cases there was agreement between the kinds of organisms found on the clothes and those obtained from the respective carrier. On the briefs and sheets of two patients with T rubrum, there were also found E floccosum together with T rubrum in the case of one of them.

#### D. DISCUSSION OF THE RESULTS

This epidemic was confined to the male patients of the Sanatorium. The women, though few in number, were not attacked. Besides the relative rarity of dermatophytosis of the groin, there was a minimum probability of contagion, because the patients live isolated from the male section and were more careful in their habits of hygiene.

At the beginning of the study, 21% of the male patients had active lesions and at least 10% had suffered recently from the same disease. Although the infection was mild -- due to its natural tendency to disappear spontaneously -- its degree of contagiousness was sufficiently high to warrant the effort to determine the ways the infection was spread so that prophylactic measures might be taken.



The low level of hygiene of the patients was demonstrated by the fact that they washed the perineal area and groin only at the time of the weekly bath. This fact, no doubt, contributed to the growth of fungi on these areas.

It is notable that the epidemic occurred in the middle of the winter, in spite of the current opinion that the lesions caused by dermatophytes develop principally in the hot months. It was impossible to determine which cases gave rise to the epidemic or the date when the epidemic started. The simultaneous isolation of two distinct species (E floccosum and T rubrum) presupposes that there was more than one original case. Both kinds were isolated on the patients in the four wards, without marked predominance of either one of them. In the one ward (A) in which only cases of E floccosum were recorded, there was a private bathroom and this dermatophyte only was isolated on the clothing and objects in this ward. The other wards were less isolated and had common bathrooms which can explain the interpropagation of infections as much by E floccosum as by T rubrum. It was impossible to clarify why the disease began on both floors of the hospital and with less frequency on the ground floor. Perhaps the fact that there were more patients on the second floor (79) than on the first (58), explains the greater possibility of contagion.

The natural way of spreading the disease is not yet known, whether it is in the groin or other parts of the hairless skin (feet, body), under the nails or on the hairy regions (scalp, beard). The numerous facts observed and data collected since Sabouraud only allows us to formulate hypotheses.

By this study it was shown that fungi may be isolated on the skin as well as on common objects and it was admitted that both human and extrahuman sources serve together in the spreading of the disease. It is hardly probable to allow for the spreading of the disease by direct contact (from groin to groin) but rather that there exists indirect contact by means of inanimate objects. The principal source of parasites must be the lesions themselves in the groins. These are generally of an acute or subacute nature and contain numerous fungi, as seen by microscopic examination. The large number of scales which fall off easily contaminate pieces of clothing and other objects. These, when used by other persons, appear to be the carriers of the parasites.

The carriers of fungi on the feet constitute a source, however of less importance. In fact, the only four sure

carriers were confined to bed and never showed that they had contaminated the floor or the shoes. Even so, on one of them was found the organism, *T mentagrophyte*, which did not produce lesions in the groins. It is doubtful that the rest of the cases would have spread the infection, because the scales eliminated by the feet had less opportunity of contaminating the objects that touched the groins. It is assumed that dermatophytosis of the groin can be acquired when towels contaminated by fungi from the feet are used (9). In this study two of the four patients with simultaneous lesions in the groins and feet had the same fungus in both places, which would be compatible with such transmission.

The above facts support the following mechanism of epidemic transmission:

The persons with lesions constitute the source of the parasites; these are eliminated with the scales and can contaminate various inert objects which serve as carriers, transporting fungi to the skin of other persons. Direct contagion, more plausible in other locations of dermatophytosis, is rare in the groin. The fungi that attack the skin of susceptible hosts can multiply, subject to favorable conditions, as careless habits of hygiene and accumulations of perspiration and secretions, producing lesions of the skin.

The chain of transmission of the disease can be broken in this way: (a) treatment of the source; (b) disinfection of the carriers; (c) frequent washing of the susceptible hosts.

The use of the three simultaneous methods would guarantee greater prophylactic success, but would bring some difficulties.

The treatment of all the infected cases, besides being somewhat impractical and expensive, is debatable as to being effective. The topical use of the usual medicines have doubtful specific effect, and do not appear to accelerate greatly the tendency of the lesions to be cured spontaneously. Griseofulvin appears to shorten the duration of the disease, but is expensive. On the other hand, none of the methods rapidly sterilizes the lesions, seeing they are only fungistatics and not fungicides. Also, it has not yet been shown that the various current treatments radically eliminate the dermatophytes that grow on the feet.

The disinfection of carriers contaminated by dermatophytes bring technical problems that vary with the kind

of objects in question. Although there is a great deal of literature about antifungus action of many different kinds of substances, there is little known of their respective practical application. (3)

It has been recommended to sterilize pieces of clothing by boiling and the disinfection of other objects with cresol, 1% formaldehyde or 10% lysol solution (10, 12).

Careful washing of persons exposed to contagion appears to play an important part in the prevention of dermatophytosis of the groin. In fact, the infection manifests itself especially in promiscuous persons and those who have poor habits of hygiene. Experimental infection is only successful in some persons and only when the inoculator is kept for days in contact with the skin (13). All authors insist that washing and careful cleaning between the toes is fundamental in the treatment of dermatophytosis of the feet because the lack of cleanliness and moisture stimulate the growth of fungi. A change in the individual habits of personal hygiene appears, then, fundamental in the prophylaxis of dermatophytosis of the groin but requires patient education and constant vigilance.

#### **E. THE PRACTICE OF PROPHYLACTIC MEASURES**

In accordance with the hypothesis formulated, the following plan of prophylactic measures is proposed, compatible with the current circumstances:

- Periodic examination of all the interneers to follow up new cases of infection.
- Separation of clothing of the patients with lesions from the rest.
- Sterilization in the autoclave of clothing used by infected patients.
- Sterilization of sanitary utensils with a 1% solution of formaldehyde.
- Improvement of the hygienic habits of the patients and the alerting of all the personnel of the Sanatorium, through direct action, during the period of investigation.

It was evidently not possible to control rigidly the execution of the established plan, but the results recorded

six months later in the middle of the summer, revealed that the epidemic was less severe. Thus:

Of the 30 original patients, 12 had left the hospital. All those who remained had had the lesions in the groin cured. Various cultures taken from the places that had had lesions were consistently negative.

During a period of six months only 11 new cases of dermatophytosis of the groin occurred. The number of infected cases diminished in all the wards, with the exception of Ward 2, where there were three cases in the first survey and six in the second.

Of the four patients who formerly had simultaneous lesions in the groins and on the feet, one had been discharged. Lesions were found in the groins of the remaining three and in spite of scaling between the toes, no dermatophytes were ever found.

Dermatophytes were found on four other persons: two with T mentagrophytes and two with E floccosum. Three of them had been observed in the first survey and only one had lesions in the groins, caused by E floccosum, which afterwards was only found between the toes.

#### F. CONCLUSIONS

The present study represents only an attempt to make an epidemiological investigation. It furnished, however, some information that can be of value in future efforts.

The contagiousness of dermatophytosis of the groin was confirmed in medical establishments for patients with chronic diseases. The disease was limited, as a rule, to the inner thigh, although in some cases it had spread to other regions. Nearly all the lesions tended to heal spontaneously.

It was found that the parasites originated from sources, constituting principally the active lesions in the groins and only rarely by carriers of dermatophytes on the feet. The transmission appears to be by indirect contact, through inanimate objects easily contaminated by contact with the lesions. It is very likely that the lack of hygiene facilitated the transmission of fungi and their multiplication on the skin of the infected persons.

Theoretically, the sequence of transmission can be broken by the treatment of sources, by disinfection of the contaminated carriers and by more careful washing of individuals exposed to contagion. In case of an epidemic, scrupulous attention should be given to the use of all three methods.

Efficient treatment is expensive and only shortens the spontaneous healing time and does not lessen the discharge of parasites until the cure. On the other hand, methods are not yet known for complete sterilization of contaminated carriers.

It is important, therefore, to cultivate good habits of hygiene, such as thorough and frequent washing of the various parts of the body with complete drying with strictly individual towels that are changed frequently. The clothing of the infected persons should be washed separately and careful disinfection of all objects that could be contaminated should be made. Because of lack of scientific data to support the use of an efficient disinfectant, careful washing with soap and running water is recommended, followed by the usual solution of 1% formaldehyde.

#### G. SUMMARY

During an epidemic of dermatophytosis of the groin which occurred in a sanatorium and which was caused by E floccosum and T rubrum, the following was observed:

1. Relative contagiousness of the infection which was limited in general to the groins but which spread eventually to other regions and had a tendency to spontaneous cure.

2. The parasites originated at sources (active lesions in the groins and, occasionally, from carriers of fungi on the feet) which must have been transmitted indirectly, by means of contaminated articles (underwear, bedclothes, towels, sanitary utensils, etc.)

3. The spreading of the disease must have been aided by lack of careful attention to hygiene.

4. In the absence of efficient fungicides to rapidly sterilize the sources, rigorous methods of disinfection of carriers and the practice of good general hygiene is recommended to combat this type of epidemic.

All the patients and the medical and nursing staff of the Dr. Jose de Almeida Sanatorium collaborated wholeheartedly in this study. A.D.M. Manuela Figueiredo, technician of the Mycological Laboratory of the University Clinic of Lisbon, helped in the mycological study and the director of this institution, Prof. Juvenal Esteves, gave valuable criticism and suggestions during the investigation.

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(1) Dermaring "Edol" (composed of 3.3% anthrarobin, 6.6% ammonium ichthammol, 33.3% sulfuric ether, 8.3% glycerin, alcohol 90 proof).

(2) This product consists of finer particles which permit better absorption and consequently a reduction in the therapeutic dose (7).

(3) At the Ninth Annual Meet. of Med. and Vet. Mycopath. (Belfast, 23-24 March 1961) the author, H. N., questioned the mycologists present about efficient methods of disinfecting shoes contaminated by dermatofytes, without obtaining a satisfactory response.

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